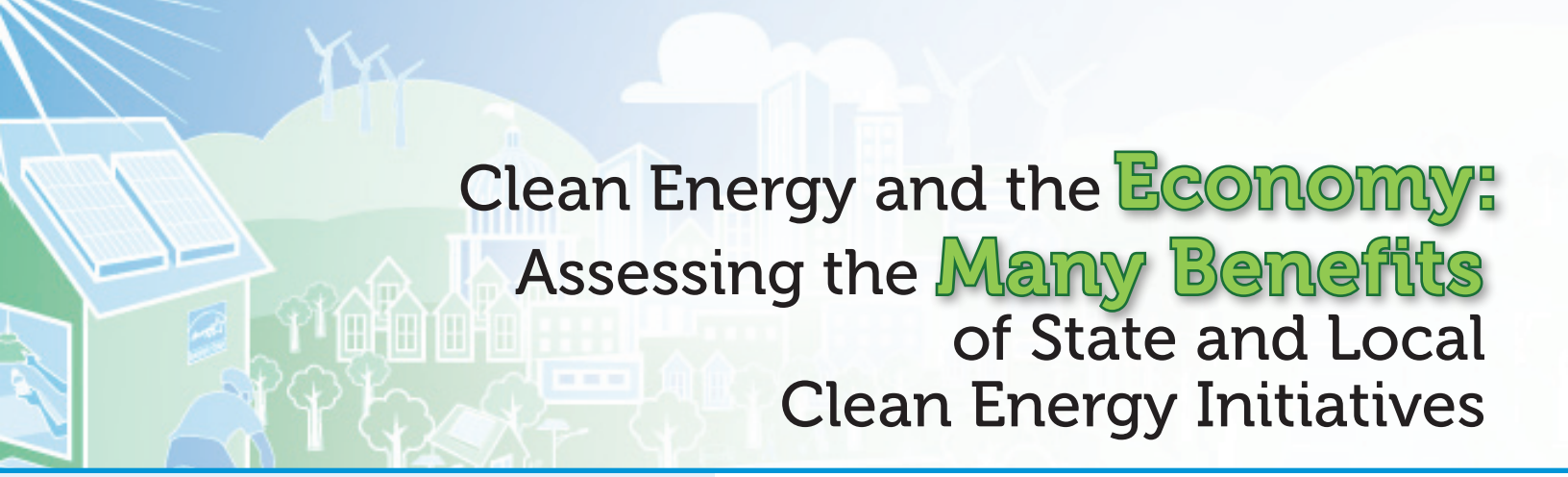

Clean Energy and the Economy: Assessing the Many Benefits of State and Local Clean Energy Initiatives

Multiple Benefits of Clean Energy Initiatives

Reducing energy demand and increasing renewable energy generation from state and local clean energy initiatives—such as goals, standards, codes, funds, and programs—generate many benefits including:

- Security, diversity, and overall reliability improvements for the electric system.
- Improved environmental quality, human health, and quality of life.
- **Increased economic prosperity.**

This brochure is part of a series and focuses on **economic benefits**.

What are the economic benefits of clean energy?

Clean energy initiatives, including those that advance energy efficiency, renewable energy and clean distributed generation can:

- Lower energy costs.
- Increase personal disposable income.
- Increase revenue for businesses.
- Increase income, employment, and output.
- Reduce fuel costs and new electric power plant construction costs.
- Reduce health care costs as a result of better air quality and public health.

How do clean energy initiatives benefit the economy?

- **Direct Economic Benefits:** Companies that provide the equipment, technologies, and services needed to implement an initiative benefit from increased demand, which increases their revenue and their ability to hire more people. In the case of energy efficiency, consumers and companies both benefit by spending less money on electricity.
- **Indirect Economic Benefits:** Suppliers to clean energy equipment and service providers benefit as demand for their inputs and revenues increase. With higher demand, these suppliers may also hire more workers.
- **Induced Economic Benefits:** Income generated from the direct and indirect effects is spent in the regional economy, such as when employees use their paychecks to buy groceries, eat out, and entertain themselves, all of which support jobs in those sectors.

What's Inside:

EPA United States Environmental Protection Agency

State and Local Climate and Energy Program

Direct economic benefits of a wind initiative could increase:

- **Sales** of wind turbines.
- **Revenue** of local turbine manufacturers.
- **Manufacturing jobs** at the local turbine manufacturing plant.

Indirect economic benefits of an increase in production of wind turbines could raise:

- **Sales** of steel to supply the turbine manufacturers.
- **Revenue** of supplier companies.
- **Jobs** of workers who supply materials to the turbine assemblers.

Induced economic benefits of a wind initiative could enhance:

- **Sales** of groceries or entertainment in the towns where turbine assembly workers live.
- **Revenue** for local businesses, such as restaurants, stores, and movie theaters, in the towns where turbine assembly workers live and spend their money.
- **Jobs** for workers at local establishments that expand or open because turbine assemblers create increased demand for their products and services.

Why assess the economic benefits of clean energy?

Clean energy can be as cost-effective as other energy options, while also delivering important electric system, environmental, and economic benefits. Typically, however, the benefits of clean energy are not as well quantified as the costs.

By quantifying the economic benefits of clean energy initiatives, policy makers can:

- ***Comprehensively assess*** the full value of clean energy investments.
- ***Strengthen how*** *benefits* are incorporated in cost-benefit analyses.
- ***Demonstrate how*** clean energy can help achieve economic development goals, including creating and retaining jobs.
- ***Build support*** for their clean energy initiatives among state and local decision makers.
- ***Identify other opportunities*** where meeting today's energy challenges can also serve as an economic development strategy.

How can policy makers estimate the macroeconomic benefits of clean energy?

States and locals can follow these basic steps to analyze the actual or potential macroeconomic benefits of clean energy initiatives:

Step 1: Determine the method of analysis, the desired level of rigor, and the required level of detail about geographic and industrial sectors.

Policy makers can use **basic approaches** or **sophisticated analyses** to estimate the economic effects of clean energy initiatives:

- ***Basic approaches*** provide relatively simple approximations of the economic feasibility and impact of clean energy initiatives. They provide quick estimates of employment, price, and output changes and are appropriate when considering broad economic impacts of proposals or conducting a preliminary analysis. Examples of easy-to-use approaches or tools include rule-of-thumb estimates, such as those that say "for every dollar spent on energy efficiency, X jobs are created" (see examples in table below).
- ***Sophisticated approaches*** provide more detailed analysis of the macroeconomic effects of clean energy initiatives and can be carried out after a list of potential initiatives has been narrowed down. ***Sophisticated modeling approaches*** include:
  - Input-output models
  - Econometric models
  - Computable general equilibrium models
  - Hybrid economic models

When choosing which methods to use, states and locals should consider many different factors, including time constraints, cost, data requirements, internal staff expertise, and overall flexibility and applicability of the methods.

RULES OF THUMB FOR ESTIMATING INCOME, OUTPUT, AND EMPLOYMENT IMPACTS OF CLEAN ENERGY ACTIVITIES

Rule of Thumb	Source
TYPE OF IMPACT: Income/Output	
1 MW of wind generated requires $1 billion investment in wind generator components.	REPP, 2005[1]
$1 spent on concentrated solar power in California produces $1.40 of additional GSP.	Stoddard et al., 2006[2]
$1 spent on energy efficiency in Iowa produces $1.50 of additional disposable income.	Weisbrod et al., 1995[3]
$1 million in energy savings in Oregon produces $1.5 million of additional output.	Grover, 2005[4]
TYPE OF IMPACT: Employment	
$1 million in energy savings in Oregon produces about $400,000 in additional wages per year.	Grover, 2005[4]
$1 billion investment in wind generator components creates 3,000 full-time equivalent (FTE) jobs.	REPP, 2005[1]
$1 million invested in energy efficiency in Iowa produces 25 job-years.	Weisbrod et al., 1995[3]
$1 million invested in wind in Iowa produces 2.5 job-years.	Weisbrod et al., 1995[3]
$1 million invested in wind or PV produces 5.7 job-years vs. 3.9 job-years for coal power.	Singh and Fehrs, 2001[5]
1 GWh of electricity saved through energy efficiency programs in New York yields 1.5 sustained jobs.	NYSERDA, 2008[6]
$1 million of energy efficiency net benefits in Georgia produces 1.6-2.8 jobs.	Jensen and Lounsbury, 2005[7]

[1]www.repp.org/articles/static/1/binaries/Ohio_Manufacturing_Report_2.pdf
[2]www.nrel.gov/docs/fy06osti/39291.pdf
[3]www.edrgroup.com/library/energy-environment/iowa-energy.html
[4]www.oregon.gov/ENERGY/CONS/docs/EcoNW_Study.pdf
[5]www.repp.org/articles/static/1/binaries/LABOR_FINAL_REV.pdf
[6]www.nyserda.org/pdfs/Combined Report.pdf
[7]www.gefa.org/Modules/ShowDocument.aspx?documentid=46

Step 2: Quantify the direct costs for and savings expected from the clean energy initiative.

For ***initiatives affecting energy demand***, such as those related to energy efficiency, direct costs and savings include:

- **Household and business expenditures:** dollars spent by businesses and households for purchasing and installing equipment.
- **Program administrative costs:** dollars spent running the program, including labor, materials, and paying incentives to participants. (*When examining the funding source for program costs, such as consumer surcharges or government revenues, policy makers should consider the impact of diverting funds from other consumer spending or projects.)
- **Energy cost savings:** dollars saved by businesses and households resulting from reduced energy costs (including electricity, natural gas, and oil cost

savings), potentially reduced repair and maintenance costs, deferred equipment replacement costs, and increased property values resulting from the new equipment.

- **Sector transfers:** increased flow of dollars to companies that design, manufacture, and install equipment, and reduced flow of dollars to other energy companies—including electric utilities—as demand for electricity and less-efficient capital declines.

Direct costs and savings of ***initiatives that affect energy supply***, such as those related to renewable energy generation, include:

- **Program administrative costs:** dollars spent operating the initiative, including labor, materials, and paying incentives to participants.
- **Construction costs:** dollars spent to purchase and install the equipment, costs of grid connection, and on-site infrastructure construction costs such as buildings or roads.
- **Operating costs:** dollars spent to operate and maintain the equipment during its operating lifetime and any costs of production surcharges applied to consumers.
- **Displacement savings:** dollars saved by utilities from the displacement of traditional generation, including reduced purchases (either local or imports) of fossil fuels and decreased operation and maintenance costs from existing generation resources.
- **Waste heat savings:** dollars saved by utilities or other commercial/industrial businesses using waste heat in Combined Heat and Power (CHP) applications for both heating and cooling purposes.

Policy makers can develop a customized approach based on their specific needs and resources by adapting and projecting results from existing initiatives in other states or regions to their own conditions or by using more sophisticated modeling tools to estimate direct effects.

Step 3: Quantify the macroeconomic impacts created by those costs and savings.

Together, the direct costs and savings of initiatives shift economic activity among participants, resulting in direct, indirect, and induced impacts on income, employment, and overall economic output such as:

- ***Increasing personal disposable income*** available for non-energy purposes by:
  - ***Reducing residential energy costs*** through energy efficiency
  - ***Reducing medical expenditures*** by decreasing pollution-related illnesses and deaths
- ***Increasing commercial and utility revenue*** available for non-energy purchases by lowering energy and fuels costs.
- ***Increasing income, employment, and output*** by:
  - ***Reducing the outflow of resources*** that leave the state when it imports electricity.
  - ***Stimulating production and sales*** of clean energy equipment by existing businesses within the state.
  - ***Increasing the inflow of resources*** that enter the state when it exports clean technology.
  - ***Stimulating construction and operation*** of new clean energy-based power facilities.
  - ***Improving competitiveness*** by lowering the in-state cost of doing business.
  - ***Expanding in-state markets*** for energy efficiency and attracting new businesses and investment.
  - ***Increasing workforce productivity*** by decreasing pollution-related illnesses and deaths.
- ***Decreasing revenue for utilities*** in states with energy efficiency initiatives that reduce energy sales (absent a state policy to "decouple" utility sales from revenues, or to otherwise compensate utilities for lost revenues).

References:

- Knutsen, K., K. Wikstrom, M. Goldberg, and S. Wright. January, 2010. Building the Clean Energy Economy: A Study on Jobs and Economic Development of Clean Energy in Utah.
- Massachusetts Secretary of Energy and Environmental Affairs. December, 2010. Massachusetts Clean Energy and Climate Plan for 2020.
- Tennessee Department of Labor and Workforce Development. November, 2008. Growing Green: The Potential for Green Job Growth in Tennessee.

Benefits Flash

A **Utah** Clean Energy analysis of the net economic effects on the State of Utah if it were to achieve a 20 percent increase in energy efficiency by 2015 and 20 percent of electricity sales from renewable resources by 2020 found that it would result in:

- Nearly **7,000 net new ongoing jobs** in the state by 2020;
- **$310 million** in net new annual earnings; and
- **$300 million net annual increase** in gross domestic product by state (GDPS).

For comparison, the Utah ski industry contributed about $440 million to state GDPS in 2008.

Source: Knutsen, K., K. Wikstrom, M. Goldberg, and S. Wright, 2010.

In 2008, the **Tennessee** Department of Labor found that:

- **40,000 direct, indirect, and induced jobs** could be created throughout the state from $1.9 billion invested in energy-efficient building retrofits, mass transit and freight rail, smart grid, and renewables including wind and solar power and advanced biofuels.
- Tennessee could gain **4,233 full-time jobs in wind** and nearly **400 in solar** by 2015 with an accelerated investment effort.

Source: Tennessee Department of Labor and Workforce Development, 2008.

Massachusetts set a goal to achieve greenhouse gas emissions levels between 10 and 25 percent lower than 1990 levels. The state developed a plan to meet the limit and estimated that the measures could:

- Create around **42,000 to 48,000 jobs** from the direct and indirect effects of the policies
  - About **13,000 from transportation** policies;
  - Approximately **23,000** to improve end use efficiency in buildings; and
  - Between **6,000 and 12,000 from in-state demand** for renewables.
- Reduce the amount of money that leaves the state for fossil fuel-based energy sources, which was valued at **$18 billion in 2008**.
- Save business, residential, and municipal customers **$6.3 billion in energy costs annually**.

Source: Massachusetts Secretary of Energy and Environmental Affairs, 2010.

Where can state and local governments and policy makers go for more information about tools, methods, and resources available to estimate the benefits of clean energy initiatives?

Assessing the Multiple Benefits of Clean Energy: A Resource for States, is an essential manual that can help you estimate and communicate the benefits of clean energy. While developed primarily for states, many of the tools and approaches discussed in the Guide are applicable for local governments as well.

What the Guide includes:

- A **framework** for determining which benefits to estimate and how.
- **Tools** and methods available for estimating energy systems and environmental economic benefits across varying levels of rigor.
- **Easy-to-read tables** that present the range of tools and approaches, their strengths and limitations, and suggestions on when to use them.
- **Benefits estimates** that states have derived using the various methods.
- **Analyses** that illustrate the use of multiple benefits to promote clean energy.
- **Case studies** in each chapter that profile how states are using the available tools to develop and implement clean energy policies and programs.

How the Guide is organized:

- ***Chapter 1*** is an introduction to assessing the multiple benefits of clean energy; it highlights the relationships between energy savings and other benefits of clean energy initiatives. Included in the chapter are discussions of the multiple benefits of clean energy and how and why states should assess these benefits.
- ***Chapter 2*** provides policy makers with methods they can use to estimate the potential direct energy impacts of electricity-related clean energy initiatives and policies for program planning, and includes:
  - Steps to estimate energy impacts of clean energy.
  - Sample framework for developing energy forecasts.
  - Energy data sources.
  - Comparisons of basic and sophisticated forecasting methods and tools.
  - Resources for retrospective data and potential studies.
  - Available tools for estimating impacts.
- ***Chapter 3*** presents detailed information about the energy system to help policy makers understand how to identify and assess the benefits of clean energy initiatives on electricity systems based on their state's needs and resources. It includes:
  - An overview of how the electricity system operates.
  - Information on how to select which benefits to evaluate.
  - Steps for estimating electricity system benefits.
  - Descriptions and comparisons of basic and sophisticated forecasting methods and tools.
  - Considerations for determining whether to analyze the various benefits, who typically estimates the specific benefits, and when the most effective time is to undertake the analyses.
- ***Chapter 4*** helps agencies assess the greenhouse gas, air pollution, air quality, and human health benefits of clean energy options, and includes:
  - Various methods to estimate air and health benefits.
  - Comparisons of different models and tools, including advantages and disadvantages, and when to use them.
  - Data needs and data sources.
- ***Chapter 5*** presents simple to sophisticated methods and tools for assessing the economic benefits of clean energy options so that states can:
  - Conduct and manage analyses.
  - Review cost-and-benefit estimates.
  - Understand the potential job effects of clean energy initiatives.
  - Make recommendations about clean energy options and appropriate evaluation approaches and tools.

How to access the Guide and get more information:

- *Assessing the Multiple Benefits of Clean Energy: A Resource for States* Web site: www.epa.gov/statelocalclimate/resources/benefits.html
- State and Local Climate and Energy Program Web site: www.epa.gov/statelocalclimate
- State and Local Climate and Energy Listserv: www.epa.gov/statelocalclimate/listservs/index.html
- Contact Information: Denise Mulholland • mulholland.denise@epa.gov • 202-343-9274